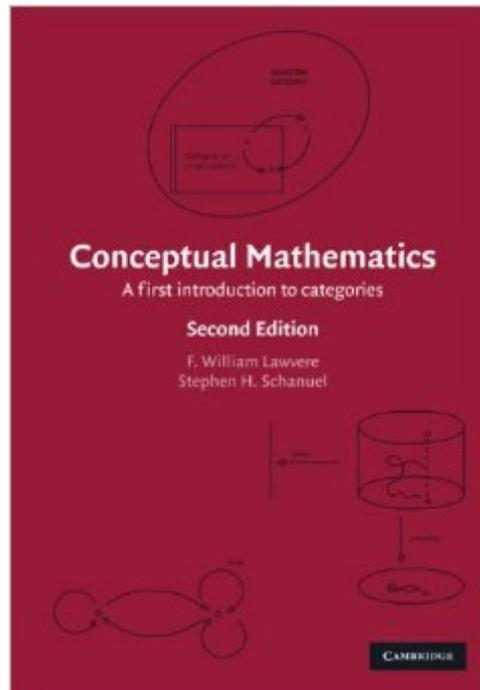# Conceptual Mathematics: A First Introduction To Categories

Synopsis

In the last 60 years, the use of the notion of category has led to a remarkable unification and simplification of mathematics. Conceptual Mathematics introduces this tool for the learning, development, and use of mathematics, to beginning students and also to practising mathematical scientists. This book provides a skeleton key that makes explicit some concepts and procedures that are common to all branches of pure and applied mathematics. The treatment does not presuppose knowledge of specific fields, but rather develops, from basic definitions, such elementary categories as discrete dynamical systems and directed graphs; the fundamental ideas are then illuminated by examples in these categories. This second edition provides links with more advanced topics of possible study. In the new appendices and annotated bibliography the reader will find concise introductions to adjoint functors and geometrical structures, as well as sketches of relevant historical developments.

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Customer Reviews

Over the last two years I have revisited different sections of this book and gain new profound insights with every read. With some dedication and time, this book will surely enrich your life! What this book offers is the truth. The concepts presented in this book are the underlying unifying ideas which make up mathematics itself in an even more general and profound sense than Set Theory (in fact, one of the authors has rigorously shown that set theory is a very special case of what is presented in this book). We can encounter categories not only at the microscopic level (where we define the fundamental ideas that allow us to construct mathematical concepts from the ground up), but at the macroscopic level as well (where complex constructions in distant fields become analogous to the microscopic building blocks). With these ideas we can show that multiplication and addition are actually more appropriately opposites of one another than addition and subtraction or multiplication and division. This book is the key to beginning a journey to discovering the true nature of mathematics. To continue (or supplement) your journey, also pick up a copy of Sets for Mathematics By F. William Lawvere and Robert Rosebrugh. With time and practice (attempt the exercises from both books!!!) you will be greatly rewarded. As a student of Mathematics, this has paid off in ways I never thought possible and continues to provide insight to nearly everything I learn in school and on my own.A startling demonstration presented in this book is that Cantor's Diagonal Argument in generalized form not only proves that there are infinite different levels of infinity, but also Godel's Incompleteness Theorem!

Not long ago, I spoke with a professor at strong HBCU department. Her Ph.D. was nearly twenty years ago, but I shocked her with the following statement, "Most of our beginning graduate students [even those in Applied Mathematics] are entering with the basic knowledge and language of Category Theory. These days one might find Chemists, Computer Scientists, Engineers, Linguists and Physicists expressing concepts and asking questions in the language of Category Theory because it slices across the artificial boundaries dividing algebra, arithmetic, calculus, geometry, logic, topology. If you have students you wish to introduce to the subject, I suggest a delightfully elementary book called Conceptual Mathematics by F. William Lawvere and Stephen H. Schanuel" [Cambridge University Press 1997].From the introduction: "Our goal in this book is to explore the consequences of a new and fundamental insight about the nature of mathematics which has led to better methods for understanding and usual mathematical concepts. While the insight and methods are simple ... they will require some effort to master, but you will be rewarded with a clarity of understanding that will be helpful in unraveling the mathematical aspect of any subject matter."Who

are the authors? Lawvere is one of the greatest visionaries of mathematics in the last half of the twentieth century. He characteristically digs down beneath the foundations of a concept in order to simplify its understanding. Though Schanuel has published research in diverse areas of Algebra, Topology, and Number Theory, he is known as a great teacher. The book is an edited transcript of a course taught by Lawvere and Schanuel to American undergraduate math students. The book was actually chosen as one of the items in the Library of Science Book Club.

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