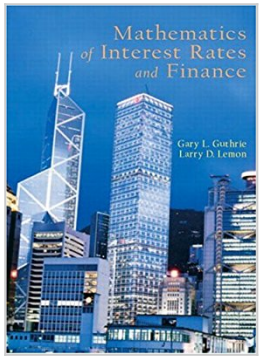

Mathematics of Interest Rates and Finance

By Gary C. Guthrie, Larry D. Lemon

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For courses in Actuarial Mathematics, Introduction to Insurance, and Personal/Business Finance.
This text presents the basic core of information needed to understand the impact of interest rates on the world of investments, real estate, corporate planning, insurance, and securities transactions. The authors presuppose a working knowledge of basic algebra, arithmetic, and percents for the core of the book: their goal is for students to understand well those few underlying principles that play out in nearly every finance and interest problem. There are several sections that utilize calculus and one chapter that requires statistics. Using time line diagrams as important tools in analyzing money and interest exercises, the text contains a great deal of practical financial applications of interest theory as well as its foundational definitions and theorems. It relies on the use of calculator and computer technology instead of tables; this approach frees students to understand challenging topics without wilting under labor-intensive details.

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Editorial Review

From the Back Cover

This book presents the basic core of information needed to understand the impact of interest on the world of investments, real estate, corporate planning, insurance, and securities transactions. Needing only a working knowledge of basic algebra, arithmetic, and percents, readers can understand well those few underlying principles that play out in nearly every finance and interest problem.Using time line diagrams to analyze money and interest, this book contains a great deal of practical financial applications of interest theory. It relies on the use of calculator and computer technology instead of tables, covering simple interest, discount interest, compound interest, annuities, debt retirement methods, stocks and bonds, and depreciation and capital budgeting.For those employed in fields of investments, real estate, corporate planning, insurance, and securities, as well as those who wish to understand the impact of interest rates on their own personal finances.

This is a math text with the primary goal of teaching students the mathematical concepts necessary for other courses dealing with finance, insurance, and investments. It presents the basic core of mathematics needed to understand the impact of interest on the world of investments, real estate, corporate planning, insurance, and securities transactions. The value of a good foundation in the mathematical principles of finance and interest becomes apparent if you peruse the mathematics found in an investment or financial management text. Basic ideas like the present value of an annuity, the net present value, the internal rate of return, and discounted cash flows are often burdened with cumbersome notation and messy formulas. The novice learner with no previous experience often finds these to be difficult and perplexing.

This text has avoided the tedious arithmetic and transcription of data from finance tables by requiring the use of financial calculators. We emphasize the use of technology with preprogrammed features, but in the advanced sections we also encourage students to program their calculators. We feel this exercise will give them an understanding of the formulas and how their financial calculators perform the various computations. Because this is a problem-solving course, students will have to demonstrate an understanding that goes beyond the numbers spit out by a calculator. This understanding comes from recognizing and diagramming the structure of the problem so that the application of a formula is natural and not just an educated guess. Our goal is for students to understand well those few underlying principles that play out in nearly every finance and interest problem.

After years of experience teaching this subject, we have developed certain simplifying techniques that have helped many students to have a successful experience in their studies of finance and interest. One of the most interesting principles involving the numbering of payments we have named the *Fence Post Principle.* This tricky little idea shows up in all walks of life, but especially in business matters. We have also found that the use of the effective interest rate makes calculations involving general case annuities just another annuity calculation without the frustrations inherent in the equivalent payment method. Students are often frustrated trying to decide whether an exercise requires present value or future value, so we teach them how to recognize certain scenarios and clue words that simplify the decision process. Most of our students reach the point at which they always get the present value/future value issue correct.

This text is intended to open the door of financial understanding to many other academic majors besides business, accounting, and the actuarial sciences. Over the years we have received considerable feedback from former students who have expressed appreciation for how this course prepared them for dealing with personal financial matters and investments. Although there are many exercises dealing with business and finance, there are many others that deal with practical issues and the profound effect of interest on the value of money. In fact, the time value of money is the basic principle underlying everything we do in finance. Those who grasp the significance of this principle are not surprised when confronted with a situation where $100 cash can actually be a larger piece of money than, say, $108 located a year from now. To emphasize this principle, we have coined a phrase called the *Golden Rule of Finance:* Monies cannot be added or reconciled unless they are valued at the same point in time. This concept drives the development of formulas and equations of value so pieces of money can be moved both forward and backward on the time line. Once the student understands where on the time line he or she wants the money, it is an easy matter to pick the right mathematical tool to get it there.

We have tried to personalize the exercises by using first names of individuals as the players in the finance problems to be solved. Most of the names of companies used are fictitious, with a few exceptions. Using the names of real companies can lead to misunderstandings if the data are not factually representative of the financial status of those companies. All problems (even a few with names of real companies) have been made up to serve the same function as any other laboratory learning situation. They are as realistic as possible, but your day-to-day financial dealings will of course be somewhat different. Interest rates are always in a state of flux, so rates in problems and examples that seem a little high for today's market may be too low in a year or two. In the summer of 2003 the prime rate had dropped to 4.00%, an impossibly low figure from the perspective of the mid-1990s, when it hovered around 8% to 9%. Backing up another decade to the 1980s, you find that the prime rate was generally above 9%.

Adaptability of the Text

We envision that this text can be adapted for use at three different levels. They could be identified as sophomore, junior, and senior; but basic, intermediate, and advanced give a better picture. The basic level would serve as a first course aimed at an audience that certainly includes, besides others, finance, management, and accounting majors. The intermediate level would provide a good background and introduction for those headed toward the actuary and insurance professions as well as financial management. The advanced level provides the additional opportunity to apply stochastic processes to finance and interest theory.

Basic Level

For those who wish to cover this material at a sophomore level in a business or accounting program, the theory sections can be omitted without loss. For this use the authors presuppose a working knowledge of only basic algebra, arithmetic, and percents, but nothing more than what would be covered in a couple of years of high school math.

Content: Cover Chapters 1 through 8, but omit the theory sections 1.10, 2.6, 3.3, 3.8, 3.9, and 5.7. This level should concentrate on the Concept and Calculation sections of the exercise sets.

Intermediate Level

Those using this text at the intermediate level would need at least an introductory-level calculus background that covered differentiation and integration along with limits and summation notation.

Content: Cover the basic material in Chapters 1 and 2 in about three class periods, cover all of Chapters 3 through 8, and four sections of Chapter 9. Give special attention to the theory sections 1.10, 2.6, 3.3, 3.8, 3.9, 5.7, 9.1-9.4. These theory of interest sections are very important to those headed toward the actuary field. Programmable calculators should be used for the Chapter 9 material. This level should plan to do a representative amount of the Concept and Calculation exercises but should do all of the Theory and Extension exercises.

Advanced Level

Those at the advanced level should not only have a Calculus prerequisite but a mathematics statistics class with adequate experience with the normal distribution from an applied as well as a theoretical standpoint. This material will assume the student can handle expected value, variance, covariance, and the lognormal distribution.

Content: Cover the same material as the intermediate level with only 1 or 2 class periods on the basic material of Chapters 1 and 2, plus all of Sections 9.5-9.9. This level should plan to do a limited amount of the Concept and Calculation exercises, all of the Theory and Extension exercises, and all of the exercises in Chapter 9.

Notation

There is a fair amount of diversity of notation among finance, investment, and actuary work. Our goal in choosing notation was two fold: (1) Keep it as simple as possible for the student learning this material, and (2) use dual notation where possible to make future transitions to other texts as smooth as possible. We have used all the basic interest theory notation that is familiar to those in the actuarial field but have tried to use more user-friendly notation in areas where the very compact methods of notation are easily forgotten with disuse. As an example of this, in Chapter 9 we use a notation for present value of a variable payment annuity with arithmetic difference. The nice feature of the user-friendly notation is that those teaching actuarial science students can use the SOA notation with our text with little or no difficulty.

To the Student

The style, presentation, and features of this text are presented with the student in mind. You should have a sense that you are sitting in our class as we make every effort to help you grasp the concepts. After we introduce and explain new concepts and principles, we try to have several relevant examples to reinforce and clarify those principles. Your goal in the study of the mathematics of finance and interest should be to gain a solid understanding of the few, but important, concepts presented in this text. When you understand what a formula does, it will be easy to remember. It will be a tool in your hand, not a burden on your back. In fact, there are not very many formulas, and what there are have been presented so they are not a mystery. Even within the theory sections every effort has been made to simplify and focus on the key elements. You will be using a financial calculator to perform all the tedious tasks like multiplying two ten-digit numbers, but punching buttons to get the correct answer is far less important than the underlying concepts. Plan to make extensive use of time lines to organize and visualize the exercises. A good time line often makes the needed steps and choice of a formula jump right out of the given information. You should carefully study the examples in the text and even work them out on your own. But if you merely use the examples as templates for working the exercises, you may find yourself deficient in the ability to reason out test questions that ire slightly different. Strive for understanding.

Some words of caution and direction are in order about exercise sets. The exercises are divided into three

types: *concept and short answer exercises; calculation exercises;* and *theory and extension.* As a further student help, Appendix D contains a complete worked-out key for all of the concept and short answer exercises, for the odd-numbered calculation exercises, and for theory and extension exercises. Such a key is a valuable aid to learning, but it can also be the road to ruin if you believe that copying the key is doing the homework. Each section's homework remains incomplete until you understand and are comfortable with the concepts in that section.

Users Review

From reader reviews:

Melvin Groth:

Have you spare time for just a day? What do you do when you have far more or little spare time? Sure, you can choose the suitable activity regarding spend your time. Any person spent their own spare time to take a stroll, shopping, or went to the particular Mall. How about open or read a book entitled Mathematics of Interest Rates and Finance? Maybe it is to be best activity for you. You recognize beside you can spend your time with your favorite's book, you can better than before. Do you agree with it has the opinion or you have additional opinion?

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Marianne Stromain:

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