

# Preface

Most business administration programs in Canadian colleges include an introductory course in business mathematics or mathematics of finance. *Business Mathematics in Canada* is intended for use in such courses. The text's primary objective is to support the learning of mathematics (other than statistics) needed to succeed in fields such as accounting, finance, management, marketing, and business information systems.

In the preparation of this edition, we have requested and received extensive feedback from business mathematics instructors through surveys and formal reviews. We have incorporated many of their suggestions in our continuing effort to make this text more motivating and helpful to students, and more supportive to instructors.

One of the Jerome hallmarks has been the quality of the problems. Even here we have been guided by user feedback to add more confidence-building problems while preserving the balance between easier and more challenging problems.

The text may be adapted to either a one- or a two-semester course in business mathematics. Chapter and section headings preceded by an asterisk (\*) may be omitted with no loss of continuity or lack of preparation for later topics. The text is suitable for courses that emphasize either an algebraic approach or a preprogrammed financial calculator approach to compound interest problems. Both algebraic solutions and financial calculator solutions are presented in most Example Problems for compound-interest topics.

## CHANGES IN THE FOURTH EDITION

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### Example 8.5E CALCULATING THE PRICE OF A STRIP BOND

A \$10,000 face value strip bond has  $15\frac{1}{2}$  years remaining until maturity. If the prevailing market rate of return is 6.5% compounded semiannually, what is the fair market value of the strip bond?

#### Solution

Given:  $FV = \$10,000$     $j = 6.5\%$     $m = 2$    Term =  $15\frac{1}{2}$  years  
Therefore,  $i = \frac{j}{m} = \frac{6.5\%}{2} = 3.25\%$    and    $n = m(\text{Term}) = 2(15.5) = 31$

$$\begin{aligned}\text{Fair market value} &= \text{Present value of the face value} \\ &= FV(1 + i)^{-n} \\ &= \$10,000(1.0325)^{-31} \\ &= \$3710.29\end{aligned}$$

The fair market value of the strip bond is \$3710.29.

31 **N**  
6.5 **I/Y**  
0 **PMT**  
10000 **FV**  
**P/Y** 2 **ENTER**  
Same C/Y  
**CPT** **PV**  
Ans: -3710.29

**Long-Term Promissory Notes** A promissory note is a simple contract between a debtor and creditor setting out the amount of the debt (face value), the interest rate thereon, and the terms of repayment. A *long-term* promissory note is a note whose term is longer than one year. Such notes usually accrue compound interest on the face value.

The payee (creditor) on a promissory note may sell the note to an investor before maturity. The debtor is then obligated to make the remaining payments to the new owner of the note. To determine the note's selling/purchase price, we need to apply the Valuation Principle to the note's maturity value. The two steps are:

1. Determine the note's maturity value based on the contractual rate of interest on the note.
2. Discount (that is, calculate the present value of) the Step 1 result back to the date of sale/purchase. Since there is no "market" for private promissory notes, the seller and purchaser must negotiate the discount rate.

The fourth edition contains many changes reflecting suggestions from users, formal reviews by 18 college and institute instructors, and initiatives of the author and publisher.

## New Presentation of Solutions in Chapters 8 to 15

The new presentation provides a better integration of algebraic and financial calculator methods. The financial calculator procedure appears in a call-out box that points clearly to the corresponding algebraic operations. The result is a more compact, less fragmented solution than in previous editions. There is now less likelihood that students will entirely ignore one method in favour of the alternative method.

## Texas Instruments BA II PLUS Calculator Shown in Examples

Previous editions presented financial calculator keystrokes for Sharp financial calculators (models EL-733A and EL-735). These keystrokes also correspond closely to those for the Texas Instruments BA-35.

In recent years, the Texas Instruments BA II PLUS financial calculator has been gaining market share. Our survey for the fourth edition indicated that more colleges use this model than the three main competitors combined (Sharp EL-733A, Texas Instruments BA-35, and Hewlett-Packard 10B). Furthermore, Sharp discontinued its EL-735 model in 2000, and Sharp's Canadian distributor could not provide comfort on the future availability of the EL-733A. For these reasons, we now present keystrokes for the Texas Instruments BA II PLUS in financial calculator solutions.



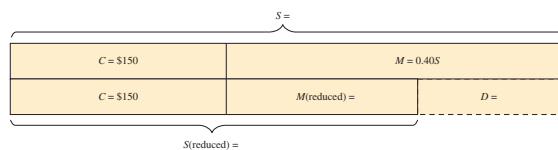
We still provide guidance to users of the Sharp EL-733A and the Texas Instruments BA-35 calculators in Tips (see, for example, Section 8.3) and in Appendixes 8A and 13A. We also flag 21 Example problems in Chapters 8, 9, 10, 11, and 13 by the icon shown in the margin at left. The icon signifies that these Examples are also solved using the Sharp EL-733A and Texas Instruments BA-35 calculators, and that the solutions can be found on the CD-ROM attached inside the back cover of this text. (The CD-ROM is described later in the Preface under Supplements.)

### Example 4.4B CALCULATING THE RATE OF MARKDOWN

An item costing \$150 was marked up by 40% of the selling price. During the store's Tenth Anniversary Sale, the selling price was reduced to \$175. What was the regular selling price, and what was the rate of markdown during the sale?

#### Solution

For all but the easiest markdown problems, it pays off to draw an expanded version of the markup diagram we employed in Section 4.3. Enter all known values on the diagram as follows.



From the diagram, we note that

$$S = \$150 + 0.40S$$

Hence,  $0.60S = \$150$

and  $S = \frac{\$150}{0.6} = \$250.00$

Enter this value on the diagram. It then becomes obvious that

$$D = S - S(\text{reduced}) = \$250 - \$175 = \$75.00$$

Therefore,

$$\text{Rate of markdown} = \frac{D}{S} \times 100\% = \frac{\$75}{\$250} \times 100\% = 30\%$$

The regular selling price was \$250.00 and the rate of markdown was 30%.

## Changes in the Treatment of Markup and Markdown

The following three changes should make these topics more straightforward for students. **First**, we now use *single*-letter symbols for the variables. The symbols  $S$ ,  $E$ ,  $P$ ,  $S(\text{reduced})$ , and  $P(\text{reduced})$  replace  $SP$ ,  $OE$ ,  $OP$ ,  $RSP$ , and  $ROP$ , respectively. **Second**, a graphic solution model replaces the previous table solution model. A majority of reviewers found the graphic model more intuitive and helpful. Instructors who prefer the table model can continue to use it, supported by the Chapter 4 Supplements in Part B of the CD-ROM.

The **third** significant change is a more judicious choice of Example and Exercise problems. Previous editions contained a few problems that, while mathematically tractable, were unrealistic and less intuitive for students. For example, it is an improbable scenario for unit cost to be an

unknown quantity while unit selling price is known. Such problems have been either revised or replaced by more realistic problems.

## Updated Tables and Problems; New Problems

Tables and Problems incorporate the most recent data at the time of writing in 2001. The interest rates used in many examples and problems have been reduced to reflect the current low-interest-rate environment.

Over 90 new problems have been added with concentrations as follows: seven in Section 1.3, 10 in Section 2.4, 6 in Section 2.5, 6 in Section 2.6, 11 in Section 3.3, 6 in Section 4.2, 10 in Section 4.3, 7 in Section 5.1, 6 in Section 5.2, 8 in Section 5.3, and 4 in Section 9.1. Many of these problems are at the confidence-building level. In addition, 250 new problems are posted on the Online Learning Centre.

## **New Points of Interest; NET @ssets boxes**

Thirteen new Points of Interest have been added, bringing the total number to 35. The “CAUGHT IN THE WEB” boxes in the third edition have been revised and renamed “NET @ssets.”

## **Resources on CD-ROM**

Some new resources are provided on the CD-ROM attached inside the back cover. More details are provided later in the Supplements section.

## **“How to Succeed in Business Mathematics” Guide**

Part A of the CD-ROM is a new guide on “How to Succeed in Business Mathematics.” It is brought to students’ attention at the beginning of each of the first four chapters. The guide may also be downloaded from the Online Learning Centre.

## **Notation Change in Chapter 8**

In the third edition, the symbols  $S$  for future value and  $P$  for present value were carried forward from simple interest in Chapter 6 and 7 to compound interest in Chapter 8. It was only after the introduction of financial calculators that we replaced  $S$  by  $FV$  and  $P$  by  $PV$ . In the fourth edition, we use only  $FV$  for future value and  $PV$  for present value throughout the compound-interest environment.

## **Other Sections Re-Written**

Section 2.6 now gives more attention to the calculation of income yield, capital gain yield, and rate of total return for each of three common securities: stocks, bonds, and mutual funds. The main thrust of Section 3.3 is now the conversion of percentage differences to proportions. The graphical method for solving two linear equations in two unknowns is added to Section 5.3. The graphical approach to cost-volume-profit analysis is now in its own Section 5.4. The exposition in Section 6.4 has been shortened and simplified.

## **OTHER KEY FEATURES**

The fourth edition of *Business Mathematics in Canada* retains the features that have been popular in earlier editions.

## **Many Canadian Applications**

Throughout the exposition, Example problems, Exercise problems, and Points of Interest, the book presents a wide range of applications of mathematics in Canadian

business and finance. Every effort has been made to reflect current practices. Real financial instruments and real economic data are frequently used.

## Wide Selection of Problems

Each section of a chapter is followed by a set of problems for applying and reinforcing the new material. The text contains over 2000 problems and concept questions. Considerable effort has been made to make the problems instructive, practical, realistic, and interesting.

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**TIP**

**Give the Complete Description of an Interest Rate**

Whenever you are asked to calculate or state a nominal interest rate, it is understood that you should include the compounding frequency in your response. For example, an answer of just “8%” is incomplete. Rather, you must state “8% compounded quarterly” if interest is compounded four times per year.

If we define the following symbols:

$j$  = Nominal interest rate  
 $m$  = Number of compoundings per year  
 $i$  = Periodic interest rate

the simple relationship between the periodic interest rate and the nominal interest rate is:

PERIODIC INTEREST RATE

(8-1)

$i = \frac{j}{m}$

**TRAP**

**“m” for Quarterly Compounding**

What is the value of  $m$  for quarterly compounding? Sometimes students incorrectly use  $m = 3$  with quarterly compounding because  $\frac{1}{4}$  year = 3 months. But  $m$  represents the number of compoundings per year (4), not the length of the compounding period.

## Tips and Traps

Boxed elements inserted at appropriate points in the text draw the student’s attention to simplifications, pitfalls, shortcuts, calculator procedures, and common errors.

RATIOS AND PROPORTIONS 97

**POINT of Interest**

**Ratios That Affect Your Eligibility for a Mortgage Loan**

Many of us go through a similar experience for the purchase of our first home. We save for a few years to accumulate enough money for the down payment. For the balance of the purchase price, we obtain a mortgage loan close to the maximum amount for which we qualify. We then struggle financially for a few years to make our early-career income cover the monthly mortgage payments and other expenditures of a young family.

Mortgage lenders must determine whether a mortgage loan is adequately secured by the property, and whether the borrower has the financial capacity to make the mortgage payments. To do this, they calculate and set upper limits on three ratios:

1. **Loan-to-Value Ratio** =  $\frac{\text{Principal amount of the loan}}{\text{Lending value of the property}} \times 100\% \leq 75\%$   
 The 75% maximum for this ratio means the borrower’s minimum down payment is 25% of the “lending value.” (The lending value is the lesser of the purchase price and the market value as determined by a certified appraiser.)
2. **Gross Debt Service Ratio (GDS ratio):**  

$$\text{GDS ratio} = \frac{\text{Total monthly payments for mortgage, property taxes, and heat}}{\text{Gross monthly income}} \times 100\% \leq 32\%$$
 The upper limit on this ratio means that the major costs of home ownership should not require more than 32% of the borrower’s gross income.
3. **Total Debt Service Ratio (TDS ratio):**  

$$\text{TDS ratio} = \frac{\text{Total monthly payments for mortgage, property taxes, and heat}}{\text{Total monthly income}} \times 100\% \leq 43\%$$

**NET @ssets**

The Canadian Imperial Bank of Commerce has a calculator (Calculate What You Can Afford) on its Web site that allows you to enter data and view the results to the

## “Point of Interest” Vignettes

Most chapters contain two or three intriguing illustrations of the application or misapplication of mathematics in business and personal finance.

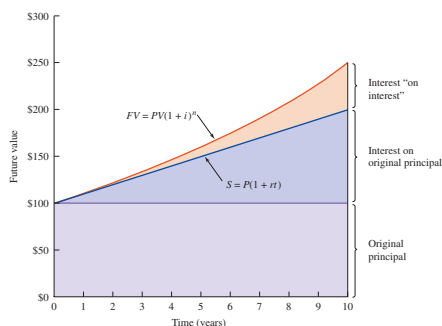
## Four-Colour Design

The use of four colours improves the clarity of diagrams and graphs, and makes the text more appealing to students.

## Net @ssets Boxes

Each of these boxed features provides a brief commentary about a Web site relevant to the topic under discussion. It may be a source of up-to-date data, a useful online calculator, an interactive chart available on the text’s Web site, etc.

**Figure 8.2** The Components of the Future Value of \$100



principal of \$100 earns 10% interest each year. At any point, the future value of the simple interest investment has two components:

1. The original principal (\$100)
2. The interest earned on the original principal. In the graph, this component is the vertical distance from the line (at \$100) to the sloping simple interest line.

Returning to the compound interest investment, we can think of its future value at any point as having three components: the same two listed above for the simple

## Graphs and Diagrams

This text makes more extensive use of graphs, diagrams, and interactive charts than other texts.

## Professional Problems

Approximately 40 problems are taken from course materials of the Canadian Institute of Financial Planning and the Institute of Canadian Bankers.



These are the two organizations most active in the delivery of financial planning courses in Canada. An icon in the adjacent margin flags these problems. The sample problems demonstrate that the topics covered in a business math course are important to these professional bodies. By solving these problems, students also gain confidence in their ability to succeed in industry-specific professional courses.

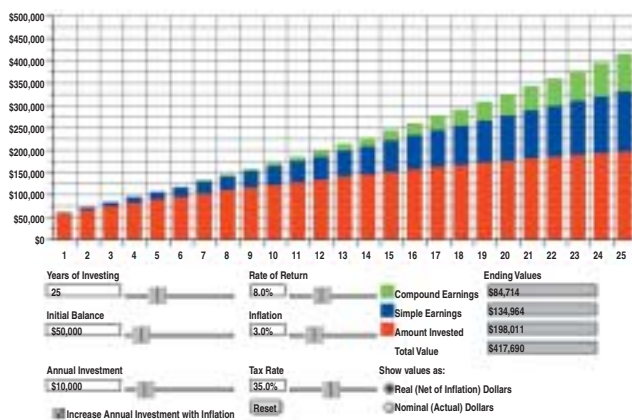
### WWW.EXERCISE.COM

1. **Using the Future Value (Due) Chart** This chart is the annuity *due* version of the (*ordinary* annuity) Future Value Chart described in the Net Assets feature in Section 10.2. Go to the textbook's home page ([www.mcgrawhill.ca/college/jerome/](http://www.mcgrawhill.ca/college/jerome/)) and select the 4th Edition. On the 4th Edition's home page, click on "Student Centre." Then select "Future Value (Due) Chart" from the list of resources. Use this chart (along with the Future Value Chart when appropriate) to answer the following problems (rounded to the nearest dollar).
  - a. Exercise 13.1, Problem 9
  - b. Exercise 13.1, Problem 13
  - c. Exercise 13.1, Problem 15
  - d. Exercise 13.1, Problem 20

end of Chapter 11. Return to that description to review the features of the chart. Repeat the first part of the suggested activity using the same initial planning assumptions as you previously employed, but instead enter these assumptions in the Cool Million (Due) chart. How much sooner will you become a millionaire if your regular savings are invested at the beginning of each month instead of at the end of each month?

3. **Components of the Future Value of an Annuity Due** Go to the Fidelity Investments Growth Calculator referred to in the Net Assets feature in Section 13.1 ([www.fidelity.ca/planning/tools/growth/growth.html](http://www.fidelity.ca/planning/tools/growth/growth.html)). A sample of the chart you will find at the Web site is shown below. (You may need to click on the "Reset" button to make the chart appear.)

Each column in the chart shows the components of the future value of a simple annuity due at the year-end. Fidelity refers to the three components as invested



SOURCE: Reproduced with permission of Fidelity Investments Canada Limited.

## Concept Questions

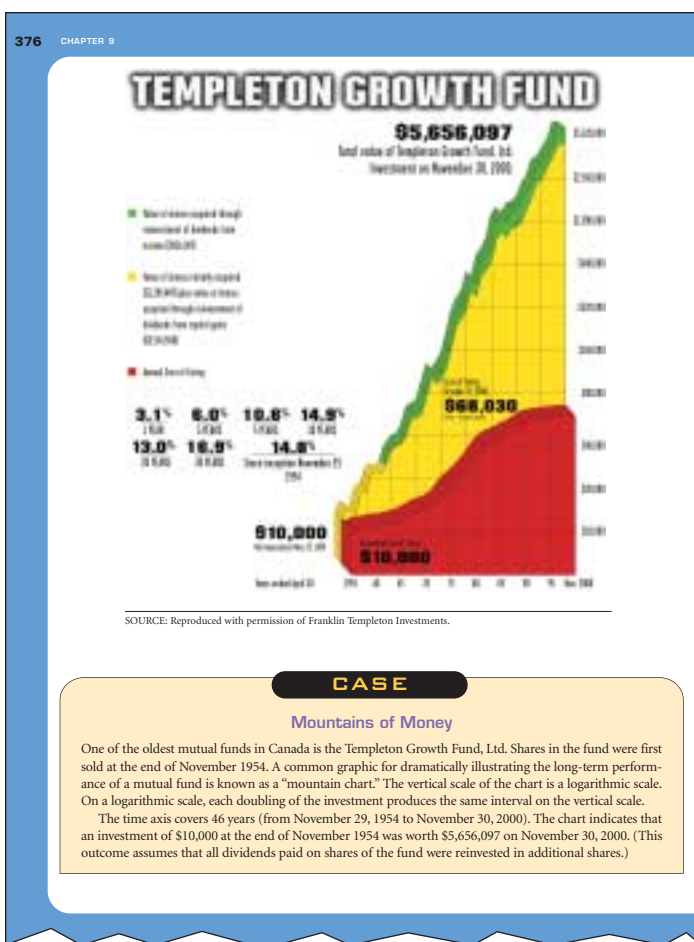
A group of Concept Questions appears at the end of many sections. These questions exercise students' intuition, and test their understanding of concepts, principles, and relationships among variables.

## www.Exercise.com

Nine chapters conclude with one or more optional Web-based activities. Typically, an activity is based on a Web site previously mentioned in a NET @ssets box.

## Inside-Cover Summaries

For quick reference, the key formulas are summarized on the inside front cover. (They are also listed on a tear-out card located as the second-to-last page of the book.) All algebraic variables with their definitions are listed on the page facing the back cover.



## Cases

Eight chapters include a case study with the end-of-chapter materials. See the List of Cases on page 00 (page # TBA).

## STUDENT SUPPLEMENTS

**Student's Solutions Manual** This manual may be purchased by students. It contains full solutions to all odd-numbered problems and Concept Questions, and to even-numbered problems in Self-Test exercises.

**Web Site and Online Learning Centre** The Student Resources area of the textbook's Web site at [www.mcgrawhill.ca/college/jerome](http://www.mcgrawhill.ca/college/jerome) includes the following features and resources:

- PowerPoint Slides organized on a chapter-by-chapter basis
- Interactive Problems (providing prompts and feedback when the student obtains an incorrect result)
- Internet Application Questions
- Multiple-choice Self-Test Quiz Questions
- Web Links to relevant sites

- **Interactive Charts** (allowing a student to change one or more input variables and immediately observe the effect on the chart)
- A guide on “**How to Succeed in Business Mathematics**” (downloadable pdf file)
- 250 extra confidence-building **practice problems**
- Texas Instruments BA-II PLUS **calculator tutorial**
- **Additional content** (Section 4 of Chapter 14, Appendix 15A, Chapter 16) in downloadable pdf files.

**CD-ROM** The CD-ROM attached inside the text’s back cover contains the following supplementary material.

- A guide on “How to Succeed in Business Mathematics”
- Example problems solved using the Texas Instruments BA-35 and Sharp EL-733A financial calculators
- Additional content (Section 4 of Chapter 14, Appendix 15A, Chapter 16)
- EXCEL Templates for spreadsheet solutions

## INSTRUCTOR SUPPLEMENTS

**Web Site** The **Instructor Resources** area of the Web site at [www.mcgrawhill.ca/college/jerome](http://www.mcgrawhill.ca/college/jerome) is password-protected. (A password will be issued on request to instructors who adopt *Business Mathematics in Canada*, Fourth Edition.) Resources include:

- Downloadable **Instructor’s Solutions Manual**
- Downloadable **PowerPoint Slides**
- 250 **extra problems** with answers
- **PageOut** development centre for course Web sites. Faculty can create online courses complete with assignments, quizzes, links to relevant sites, and more—in a matter of minutes, and free to instructors.
- Downloadable pdf files containing all **Test Bank questions**
- Content for this text is available for both the popular **WebCT** and **Blackboard** environments, allowing instructors to bring their teaching and learning online.
- **Primis Online** enables instructors to design custom print and electronic materials for their courses from McGraw-Hill’s digital content repository.
- Problem solutions employing **EXCEL Templates**

**Computerized Test Bank** Instructors receive special software to select both multiple-choice questions and problems requiring full solutions. These questions and problems may be selected according to topic and degree of difficulty criteria. Instructors may edit test items and add new questions to the test bank.

## ACKNOWLEDGEMENTS

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The problems attributed to The Institute of Canadian Bankers and the Canadian Institute of Financial Planning used throughout the text are the property of the respective institutions and have been used with their expressed permission.

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*Ernie Jerome*