



- d. Calculate the appropriate equivalent single value [present value, net present value, future (accumulated) value or combination], given a set of cash flows (level or varying), where the cash flows may occur as frequently or more frequently than interest or discount is accrued, an appropriate term structure of interest rates, the method of crediting interest (e.g., portfolio or investment year) as necessary, an appropriate set of inflation rates as necessary, and accounting for reinvestment interest rates as necessary.

For example:

- i. Calculate the loan amount or outstanding loan balance, given a set of loan payments (level or varying) and the desired yield rate (level or varying).
  - ii. Calculate the price of a bond (callable or non-callable), given the bond coupons, the redemption value, the term of the bond (constant or varying), the coupon interest rate, and the desired yield rate (level or varying).
  - iii. Calculate the value of a stock, given the pattern of dividends and the desired yield rate (level or varying).
  - iv. Calculate the net present value, given a set of investment contributions and investment returns.
- e. Calculate a unique yield rate, when it exists, given a set of investment cash flows.
- f. Calculate the amount(s) of investment contributions, given there is more than one contribution, and given a set of yield rates, the amount(s) and timing of investment return(s), and the desired timing of the investment contributions.
- g. Calculate the amount(s) of investment returns, given there is more than one return, and given a set of yield rates, the amount(s) and timing of investment contribution(s) and the desired timing of the investment returns; for example:
- i. Calculate loan payments, given the loan amount(s), the term of the loan, and the desired yield rate (level or varying).
  - ii. Calculate the principal and interest portions of a loan payment, given the loan amount, the set of loan payments (level or varying), and a set of interest rates (level or varying).
  - iii. Calculate bond coupons or redemption values, given the bond price, the term of the bond, and the desired yield rate (level or varying).
- h. Calculate the term of an investment, given a set of cash flows (level or varying), and a set of interest rates (level or varying); for example:
- i. Calculate the length of time required to accumulate a given amount, given the yield rate and an initial amount.
  - ii. Calculate the length of time to repay a given loan amount, given the loan payments and the loan interest rate(s).
  - iii. Calculate the time to maturity of a bond, given the price of the bond, the coupon payments, redemption value, and yield rate.
3. Candidates will know definitions of key terms of modern financial analysis at an introductory and intuitive level, and be able to complete basic calculations involving such terms: yield curves, spot rates, forward rates, duration, convexity, and immunization.

Specifically, candidates are expected to demonstrate the ability to:

- a. Choose the term, given a definition.
- b. Write the definition, given a term.
- c. Perform calculations such as:
  - i. measuring interest rate risk using duration and convexity.
  - ii. basic immunization calculations.
  - iii. cash flow matching calculations (the terms dedication and asset-liability matching are used in the readings as equivalent to cash flow matching).

4. Candidates will know definitions of key terms of financial economics at an introductory level: derivatives, forwards, futures, short and long positions, call and put options, spreads, collars, hedging, arbitrage, and swaps.

Specifically, candidates are expected to demonstrate the ability to:

- a. Explain the need for financial risk management. Explain how derivative securities can be used as tools to manage financial risk. Explain the reasons to hedge and not to hedge.
- b. Define, evaluate payoff, and evaluate profit of basic derivatives contracts [forward contracts, futures contracts, American and European put and call options, simple commodity swaps, and interest rate swaps].
- c. Define, evaluate payoff, and evaluate profit of basic trading strategies [floors, caps, covered puts and calls, synthetic forwards, spreads (including bull, bear, box, and ratio spreads), collars (including zero-cost collars), and straddles (including strangles, written straddles, and butterfly spreads)].
- d. Explain no-arbitrage pricing including put-call parity and pricing of prepaid forward contracts on stocks (with and without dividends). Explain arbitrage with respect to synthetic forward contracts and the effect of transaction costs.
- e. Determine forward price from prepaid forward price. Explain the relationship between forward price and futures price. Explain the relationship between forward price and future stock price.

### **Textbooks**

Knowledge and understanding of financial mathematics concepts are significantly enhanced through working out problems based on those concepts. Thus in preparing for the Financial Mathematics examination, whichever of the source of textbooks candidates choose to use, candidates are encouraged to work out the textbook exercises related to the listed readings.

### **Suggested Textbooks for topics in Learning Outcomes 1 through 3**

There is not a single textbook required for the topics covered by Learning Objectives 1 through 3. The texts listed below are representative of the textbooks available to cover the material on which the candidate may be tested. Not all topics may be covered at the same level in each text. The candidate may wish to use one or more texts in their preparation for the examination. The # indicates new or updated material or changes in the sections selected.

### **REFERENCES**

- # Broverman, S.A., *Mathematics of Investment and Credit* (Fourth Edition), 2008, ACTEX Publications:
  - Chapter 1 (1.1-1.7)
  - Chapter 2 (2.1 -2.4 excluding 2.4.2 and 2.4.3)
  - Chapter 3 (3.1-3.3, excluding 3.2.1 and 3.2.2)
  - Chapter 4 (4.1-4.3.1)
  - Chapter 5 (5.1-5.3 excluding 5.1.4 and 5.3.2)
  - Chapter 6 (6.1-6.3 excluding 6.2)
  - Chapter 7 (7.1-7.2)
  - Chapter 8 (8.1, 8.3.1 and 8.4.1–8.4.2)

**NOTE: Candidates may also use the Third Edition of *Mathematics of Investment and Credit*. The following chapter references apply:**

Chapter 1 (1.1-1.6)  
Chapter 2 (2.1 -2.4 excluding 2.4.2 and 2.4.3)  
Chapter 3 (3.1-3.3 excluding pp. 188–189)  
Chapter 4 (4.1-4.3.1)  
Chapter 5 (5.1-5.3 excluding 5.1.4 and 5.3.2)  
Chapter 6 (6.1-6.3 excluding 6.2)  
Chapter 7 (7.1-7.2)  
Chapter 8 (8.2.1, 8.2.4, 8.3.1–8.3.2).

- # Daniel, J.W. and Vaaler, L.J.F., *Mathematical Interest Theory*, (Second Edition) 2008, The Mathematical Association of America,

Chapter 1 (1.3-1.12, 1.14)  
Chapter 2 (2.2-2.7)  
Chapter 3 (3.2-3.9, 3.11, 3.13)  
Chapter 4 (4.2-4.6)  
Chapter 5 (5.2-5.4)  
Chapter 6 (6.2-6.6, 6.9)  
Chapter 7 (7.1)  
Chapter 8 (8.3)  
Chapter 9 (9.1-9.5)

**NOTE: Candidates may also use the First Edition of *Mathematical Interest Theory* (Publisher: Prentice Hall). The same chapter references apply.**

- Kellison, S.G., *The Theory of Interest* (Third Edition), 2008, Irwin/McGraw-Hill,

Chapter 1 (1.2-1.10)  
Chapter 2 (2.3-2.6)  
Chapter 3 (3.2-3.8)  
Chapter 4 (4.2-4.9)  
Chapter 5 (5.2-5.6)  
Chapter 6 (6.2-6.7, 6.10)  
Chapter 7 (7.2-7.7)  
Chapter 9 (9.4)  
Chapter 10 (10.2-10.5)  
Chapter 11 (11.2-11.8)

- Ruckman, C, and Francis, J., *Financial Mathematics: A practical Guide for Actuaries and other Business Professionals* (Second Edition), 2005, BPP Professional Education,

Chapter 1  
Chapter 2  
Chapter 3 (3.1-3.9)  
Chapter 4 (4.1-4.5)  
Chapter 5  
Chapter 6 (6.1-6.3 excluding 6.1.6-6.1.7)

Chapter 7 (7.1-7.9)  
Chapter 8 (8.1-8.3)

**Textbook for the topics in Learning Outcome 4**

- McDonald, R.L., *Derivatives Markets* (Second Edition), 2006, Addison- Wesley,

Chapter 1 (1.1-1.4)  
Chapter 2 (2.1-2.6 and Appendix 2.A)  
Chapter 3 (3.1-3.5)  
Chapter 4 (4.1-4.4)  
Chapter 5 (5.1-5.4 and Appendix 5.B)  
Chapter 8 (8.1-8.2)

**Study Notes:** The # indicates new or updated material.

<b>Code</b>	<b>Title</b>
	<i>Derivatives Markets</i> , Errata, 2006 Second Edition, by R. McDonald <a href="http://www.kellogg.northwestern.edu/faculty/mcdonald/htm/typos2e.html">http://www.kellogg.northwestern.edu/faculty/mcdonald/htm/typos2e.html</a>
	<i>Mathematics of Investment and Credit</i> , Errata, 2004 Third Edition, by S. Broverman <a href="http://www.actexamdriver.com/client/client_pages/actex_errata2.cfm">http://www.actexamdriver.com/client/client_pages/actex_errata2.cfm</a>
	<a href="#">Notation and terminology used for Exam FM/ Exam 2</a>
Past Exams	All released exam papers, since 2000, can be found at: <a href="http://www.soa.org/education/resources/edu-multiple-choice-essay-examinations.aspx">http://www.soa.org/education/resources/edu-multiple-choice-essay-examinations.aspx</a>
FM-09-05	Exam FM Sample <a href="#">Questions</a> and <a href="#">Solutions</a>
FM-09-07	<a href="#">Sample Questions and Solutions</a> for <i>Derivatives Markets</i>
FM-22-05	<a href="#">Review of Calculator Functions for the Texas Instruments BA-35</a>
FM-23-05	<a href="#">Review of Calculator Functions for the Texas Instruments BA II Plus</a>