

E-workbook: Mathematical Techniques in Finance

Thoroughly explores the advanced mathematical techniques used in modern finance. Requiring comprehensive knowledge of the underlying principles and utilising methods from calculus, this e-workbook facilitates mastery of the theory of interest and stimulates rigorous analysis of the techniques used in pricing, financing, investing, trading and managing risks and returns. The e-workbook combines academic thought, proof, theory and the application of formulas.

Measuring interest involved in single payment transactions

- Interest accumulation
- Nominal and effective rates of interest and discount
- The force of interest
- Future value at simple, compound and continuous rates
- Present value at simple, compound and continuous rates
- Equations of value
- Adjusting for inflation

Annuity valuation

- Future value of an ordinary annuity
- Future value of an annuity-due
- Present value of an ordinary annuity and an annuity-due
- Solving for the term, payment and yield of an annuity
- Valuation of deferred annuities
- Present value of a perpetuity as the limit of an annuity
- Valuing annuities with varying interest and periodic payments
- Continuous annuities
- Valuing annuities with inconsistent compounding and payment frequencies
- Valuing annuities that form a geometric progression
- Valuing annuities that form an arithmetic progression
- Applications to reinvestment risk, depreciation and other real world problems

Loans

- Amortisation method of loan repayment
- Developing an amortisation schedule
- Retrospective and prospective methods of loan outstanding
- Adjusting the repayment and/or term in response to changes in the loan interest rate
- Sinking-fund method of loan repayment
- Applications to valuing loans and other real world problems

Valuation of bonds

- Pricing a bond on a coupon date
- Pricing a bond between coupon dates
- Solving for the yield to maturity implied in a bond purchase
- Holding period return allowing for reinvestment rates
- Amortisation of a bond
- Allowing for income and capital gains tax on bonds
- Applications to callable and serial bonds

Probability and random variables

- Introduction to the theory of probability
- Rules of probability and enumeration
- Random variables
- Probability distributions
- Expected value and variance
- Applications to portfolio theory

The rate of return on an investment

- Internal rate of return and net present value
- Payback period
- Profitability index
- Dollar-weighted rate of return
- Time-weighted rate of return
- Applications to investment decisions and fund management with continuous transactions

The term structure of interest rates

- Spot and forward rates
- Yield curves
- The relationship between spot rates and bond yields
- Applications to arbitrage and interest rate swaps
- Duration and immunisation
- Duration of a series of cash flows and bond duration
- Convexity of a series of cash flows
- Asset-liability matching and immunisation
- Applications to interest rate risk management

Valuing securities and financial instruments

- Pricing using the arbitrage principle
- Forward and futures contracts
- Modelling shares using the CAPM approach
- Modelling using the binomial and Black-Scholes approaches
- Fixed income investments and bond default risk
- Foreign exchange rates and the interest rate parity theorem