
Financial Mathematics

Overview

Financial Mathematics is an essential building block for beginners in the finance industry. It exposes the user to fundamental concepts such as cash flows, present value, future value, yield and probability that form the basis for further in-depth learning.

Learning Outcome Statements

- Understand the dynamics of cash flows
- Calculate the various yield measures such as current yield and yield-to-maturity
- Calculate the price of option-free bonds and price/volatility characteristics of bonds with embedded options
- Comprehend volatility and correlation as well as methods to calculate them

Key Contents

- Basic Mathematics
 - Simple powers
 - Square roots and higher order roots
 - Summation and products
 - Maxima and minima
 - Exponential and logarithmic functions
 - Continuous compounding equation
 - Discrete and continuous compounding
 - Geometric mean
- Basic Statistics
 - Arithmetic mean, mode, median
 - Weighted average
 - Variance and standard deviation
 - Skewness and kurtosis
 - Covariance, variance, covariance matrix
 - Correlation coefficient, variance of two variables, correlation matrix
 - Volatility, arithmetic of volatility, calculation of volatility (using historical data), conversation of volatility
- Basic Calculus
 - Differential calculus
 - Integral calculus
- Basic Probability Theory

- Normal distribution
- Confidence interval
- Standard normal distribution
- Lognormal distribution
- Money Markets
 - Simple money market calculations
 - Time value of money
 - Simple interest calculations, compound interest calculations
 - Present value, discount factor, annuity, future values, sinking fund
 - Discount Rate and Interest Rate
- Capital Market Mathematics
- Bond Mathematics
 - Yield to maturity
 - Present value of bond
 - Bond price and its calculations
 - Bond duration and maturity
 - Risk measurement of a bond
 - Bond convexity
- Yield Curve- Mathematics, Construction and Analysis
 - Yield curve- basics, shapes, risk and return
 - Compounding and discounting, spot rate, zero coupon rates
 - Forward rate- basics, annual time period swap rate
 - Yield curve using money market rates
 - Zero coupon and yield to maturity
 - Bootstrapping
 - Yield curve from bond data
 - Zero coupon yield from coupon paying bonds
 - Yield from price, present value of cash flow
 - Calculation of forward rates from discount factors
 - Concept of factor sensitivity
- Financial Derivatives- Stock and Currency Options Markets
 - Mathematics as applied to derivatives
 - Diffusion process
 - Asset price model
 - Financial options
 - Black Scholes pricing
 - Garman Kohlhagen pricing equation
 - Options hedging, option greeks, mathematics of risk variables