PI ETA CONSULTING COMPANY

Financial Mathematics
Part I

The Alpha, #03-16A, 10 Science Park Road, Singapore Science Park II
Singapore 117684, Republic of Singapore
Tel: +65 634 100 10 | Fax: +65 634 100 20 | Email: marketing@pi-eta.com

OUTLINE FOR FINANCIAL MATHEMATICS PART I PROGRAM, A 2-DAY PROGRAM

- **Preliminaries**
  - Sets
  - Indices and Logarithms
  - Group Discussion/Assignment
    - Perform some basic calculations of Indices and Logarithms
    - Explore the use of Indices and Logarithms in the computation of Continuously Compounded Interest Calculations with working examples

- **Series & Sequences**
  - Examples of Series & Sequences
  - Definitions of Convergence
  - Various Tests for Convergence
  - Arithmetic Progressions and Series
  - Geometric Progressions and Series
  - Applications in Financial Markets
  - Group Discussion/Assignment
    - Present-values of Bond coupons can be considered as examples of Series. Discussion to provide further examples of Series & Sequences in Finance
    - Applying Progressions and Series to simplify computations in Bond Price Analysis
    - Discussion of other applications in Company Valuation

- **Relations and Functions**
  - Definition of a Relation
  - Definition of a Function
  - Some Basic Algebraic Functions
  - Graph of a Function
  - One-to-one (Injective) Functions
  - Onto (Surjective) Functions
  - One-to-one and Onto (Bijective) Functions
  - Inverse and Identity Functions
  - Composite Functions
  - Group Discussion/Assignment
    - Discuss the use of Functions in Finance. Example of the Bond Price as a function of Yield-to-maturity
    - To identify other Functions commonly used in Financial markets and to determine whether they are Injective, Surjective and Bijective

- **Differentiation**
  - Gradient and Derivative
  - The Derivative of x^n
  - Differentiation of Sum, Difference, Product and Quotient
  - The Chain Rule
  - Exponential Functions
  - Logarithmic Functions
  - Differentiation of Exponential and Logarithmic Functions
  - Higher Derivatives
  - Applications of Differentiation and Derivatives
    - Rates of Change
    - Maxima and Minima
    - Small Increments
  - Applications in Financial Markets
  - Group Discussion/Assignment
    - Compute Derivatives for some given known functions
    - Case Study to explore the significance of Gradient, Derivative and Higher Derivatives of Functions commonly used in financial markets
    - Case Study to explore the use of Exponential Functions and Logarithmic Functions in the financial markets
    - Explore the use of Differentiation theory in Portfolio Management

- **Integration**
  - Introduction
  - The Indefinite Integral
  - The Definite Integral
  - Some Properties of Integrals
  - Applications in Financial Markets
  - Group Discussion/Assignment
    - Compute Integrals for some given functions
    - Interpreting results computed for Integrals in real-world sense
    - Case Study to explore the use of Integration theory in Financial Markets

- **Taylor Series**
  - Taylor's Formula
  - Maclaurin Series as a Special Case of the Taylor Series
  - Applications in Financial Markets
    (A classic application to Bonds will be discussed in a latter module)
  - Group Discussion/Assignment
    - Compute Taylor's Series for some given functions
    - Case Study to explore the key fundamental use of Taylor's Formula in Market Risk Management and other areas of Finance

- **Vectors**
  - Introduction To Vectors
  - Fundamental Results and The Ratio Theorem
  - Addition of Vectors
  - Multiplication of a Vector by a Scalar
  - Scalar Product of Two Vectors
  - Applications in Financial Markets
  - Group Discussion/Assignment
    - Perform some basic vector computations
    - Case Study to explore the use of Vectors in Portfolio Management and other areas in Finance

- **Matrices**
  - Introduction To Matrices
  - Square Matrices
  - Transpose of a Matrix
  - Addition of Matrices
  - Null or Zero Matrices
  - Subtraction of Matrices
  - Multiplication of a Matrix by a Scalar
  - Multiplication of Matrices
  - Inverse of a Square Matrix and Determinants
  - Applications in Financial Markets
  - Group Discussion/Assignment
    - Perform some basic Matrix computations
    - Case Study to explore the use of Matrices in Portfolio Management and other areas in Finance

PROGRAM FACILITATOR

Dr. Jeffrey C. K. Lim
Ph.D., C.Sci., C.Math., FIMA, FRM, PRM, B.Fel.

Dr. Jeffrey C. K. Lim, certified Financial Risk Manager (FRM[1]) and certified Professional Risk Manager (PRM[2]), is currently the Managing Director of PI ETA Consulting Company, a Treasury & Financial Risk Management Consulting Company.

A Chartered Scientist (C.Sci.[3]), a Chartered Mathematician (C.Math.[4]) and an elected Fellow of the Institute of Mathematics and Its Applications (IMA), U.K. (FIMA), Jeff earned his Ph.D. in Stochastic Financial Modeling from the University of Cambridge in England. Jeff's research interest at Cambridge was in the area of Arbitrage Opportunities occurring in the Mispricing of Financial Options, and his original research culminated in the publication of his doctoral dissertation entitled: "Multi-period Mean-Variance Option Portfolio Strategies".

Jeff was an authorized Securities & Financial Derivatives Representative in London, having been certified by The Securities and Futures Authority (SFA) in England, where he started his career as a Derivatives Analyst with Nomura International in London, England. He subsequently joined NatWest Markets from London, England to become its Head of Currency Structured Products for South and South-East Asia. Jeff then moved to American Express Bank to become its Director of Structured Products, prior to assuming his current position.

Jeff has also contributed to the development and enhancement of talent and infrastructure for Singapore's financial center as a guest Professor at the National University of Singapore's Center for Financial Engineering, where he was responsible for the curriculum of its Master of Science degree program's core modules in Financial Derivatives and Treasury Management. In addition, Jeff has also been invited by the Nanyang Technological University and the Singapore Management University to share his expertise in a similar capacity. In recognition of Jeff's expertise and experience in the field of Treasury and Financial Risk Management, the University of New South Wales Asia appointed Jeff to be its first Adjunct Professor with the university's Division of Business and Humanities.

At PI ETA Consulting Company, Jeff was Principal Inventor in two of the Patents that the company currently holds – one in Treasury & Financial Risk Management Systems, and the other in Knowledge Management Systems.

Professionally, Jeff is a Fellow of both The Global Association of Risk Professionals (GARP), U.S.A. and The Professional Risk Managers International Association (PRMIA), U.S.A. He is also a Fellow of the Cambridge Philosophical Society, U.K. and a Life-time Member of The Cambridge Society, U.K. Jeff is also honoured to be a Fellow of The Cambridge Commonwealth Society, U.K., having been previously awarded the Cambridge Commonwealth Trust and the Shell Group of Companies Doctoral Research Scholarship.

---

[1] The *Financial Risk Manager* (FRM) designation is awarded by The Global Association of Risk Professionals (GARP), U.S.A.

[2] The *Professional Risk Manager* (PRM) designation is awarded by The Professional Risk Managers International Association (PRMIA), U.S.A.

[3] The *Chartered Scientist* (C.Sci.) designation is awarded by The Science Council, U.K.

[4] The *Chartered Mathematician* (C.Math.) designation is awarded by The Institute of Mathematics and Its Applications (IMA), U.K.

As a special recognition of Jeff's professional achievements, on 9 April 1999, Barons Who's Who conferred Jeff with the Barons Fellowship status, making him a Barons Fellow (B.Fel.). This award by their Charter, is limited to only the top 10% of those selected for publication in Barons Who's Who International.