Mathematics for Business II

Assignment Guidelines:

This task evaluates the fundamental principles and advanced tools of quantitative analysis and business mathematics, focusing on differential calculus, constrained and unconstrained optimisation, matrix algebra, input-output models, and integral calculus. Students are expected to solve real-world economic and business problems, perform quantitative modelling using spreadsheets or mathematical tools, and interpret computational results to guide sound operational, pricing, and resource allocation decision-making.

Submission Format:

- **Type:** Practical Analytical Report (Quantitative Business Modelling Project)
- **Font/Spacing:** Times New Roman, Size 12, Double Spaced
- **Word Count:** 1500 – 2500 words (excluding formulas, mathematical tables, and computational appendices)
- **Submission Deadline:** To be announced by the respective professors

Assessment Criteria:

- Understanding and application of advanced mathematical concepts and methods – 20%
- Accuracy of quantitative modelling, formula execution, and spreadsheet/software usage – 25%
- Critical interpretation of mathematical and optimisation results in business contexts – 20%
- Strategic managerial insight, resource allocation evaluation, and quality of recommendations – 25%
- Structure, technical reporting clarity, presentation, and APA referencing – 10%

Mandatory Sections:

- Title Page
- Table of Contents
- Executive Summary
- Introduction
- Theoretical Framework & Mathematical Formulation
- Quantitative Calculations & Optimisation Models
- Discussion & Managerial Implications
- Conclusion & Recommendations
- References
- Appendices (Spreadsheet Output & Problem Solutions)

Assignment Task – Choose ONE of the following practical projects:

Option 1: Multi-Product Optimisation, Marginal Analysis, and Pricing Strategy

Evaluate multivariate functions and calculus-based optimisation techniques to maximise profits and optimise pricing strategies for a multi-product enterprise. Your paper should:

- Formulate multi-variable profit, revenue, and cost functions using partial derivatives and marginal analysis.
- Apply unconstrained and constrained optimisation models (e.g., Lagrange multipliers) to determine optimal output quantities and price points under budget or resource constraints.
- Analyse real-world corporate pricing and production strategies in business operations that utilise differential calculus for marginal decision-making.
- Develop a spreadsheet-based optimisation model and pricing framework to maximise firm profitability.

Option 2: Input-Output Matrix Algebra and Supply Chain Interdependency Analysis

Investigate linear algebra applications and Leontief input-output models to evaluate resource dependencies, production planning, and operational equilibrium across business sectors. Your paper should:

- Construct and solve a system of linear equations using matrix operations (inverses, determinants, Gaussian elimination) and Leontief structural matrices.
- Calculate the total production required across multiple production units to meet changes in final market demand.
- Analyse real-life industry or macro-economic case studies where input-output matrix models prevented operational bottlenecks or structural supply chain disruptions.
- Recommend a matrix-based operational planning framework that guides long-term capacity and resource allocation decisions.

Option 3: Integral Calculus, Economic Surplus, and Long-Term Capital Accumulation

Analyse integral calculus applications to model continuous revenue streams, cumulative cost functions, consumer surplus, and producer surplus in dynamic market environments. Your paper should:

- Formulate and calculate definite and indefinite integrals to determine total cost, total revenue, consumer surplus, and producer surplus at market equilibrium.
- Apply continuous integration models to evaluate the present and future value of continuous income streams and capital accumulation over time.
- Discuss real-world economic scenarios and market equilibrium models where integration techniques inform tax impact analysis and long-term capital forecasting.
- Create a mathematical evaluation roadmap that informs financial planning, cost control, and market efficiency strategies.