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B.Com Honours

Semester II

Calicut University

Fundamentals of Business Mathematics and Statistics

Course Code: COM2MN104 • Module 1 Notes

1. Business Mathematics: Simultaneous and Quadratic Equations

Mathematics provides the quantitative tools necessary to model business behavior, optimize resource allocation, and evaluate financial outcomes. Entrepreneurs and analysts model supply, demand, costing, and investment behaviors using algebraic equations. This module covers numerical expressions, simultaneous linear equations (up to three variables) using algebraic and determinant methods, and quadratic equations in one variable with their business applications.

Simultaneous Linear Equations

Simultaneous linear equations represent a set of equations containing multiple variables that are satisfied by the same values. In business, they are used to determine product-mix options or market equilibrium.

- **Two Variables:** Equations in the form of $(ax + by = c)$ solved using **Substitution** or **Elimination** methods.
- **Three Variables:** Solved systematically using **Elimination** or **Cramer's Rule** (using determinants of matrices).

Quadratic Equations in One Variable

A quadratic equation is in the form of:

$$[ax^2 + bx + c = 0 \text{ quad } (\text{ext}\{\text{where } a \neq 0\})]$$

In business, quadratic equations model total revenue and cost curves, helping determine profit-maximizing volumes. They are solved using two main methods:

1. Factorization Method

Splitting the middle term to factor the equation into two linear binomials. E.g., $(x^2 - 5x + 6 = 0 \rightarrow (x-2)(x-3) = 0 \rightarrow x = 2, 3)$.

2. The Quadratic Formula

The universal formula to find the roots (solutions) of any quadratic equation:
 $[x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}]$ Where the term under the square root $((b^2 - 4ac))$ is called the discriminant, determining if the roots are real or imaginary.

Business Applications of Equations

Firms use algebraic modeling to determine critical operational milestones:

- **Market Equilibrium:** Equating the Demand Equation (Q_d) and Supply Equation (Q_s) to determine the equilibrium price (P) and quantity (Q).
- **Break-Even Analysis:** Setting Total Revenue equal to Total Cost ($TR = TC$) to find the break-even output quantity.

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