

MBA 2306
BUSINESS MATHEMATICS

স্কুল অব বিজনেস
SCHOOL OF BUSINESS



Bangladesh Open University
বাংলাদেশ উন্মুক্ত বিশ্ববিদ্যালয়



This book is licensed under a
Creative Commons Attribution 4.0 International License.

স্কুল অব বিজনেস
SCHOOL OF BUSINESS
বাংলাদেশ উন্মুক্ত বিশ্ববিদ্যালয়

MBA 2306
Business Mathematics

—Course Development Team—

Writer

Professor Dr. M. A. Taher
Department of Management
University of Chittagong
Chittagong

Dr. Mohammed Shamim Uddin Khan

Associate Professor
Department of Finance & Banking
University of Chittagong
Chittagong

Editor and Style Editor

S. M. Miraj Ahmmod
Associate Professor
School of Business
Bangladesh Open University

Coordinator

Prof. Dr. M. Ekramul Hoque
School of Business
Bangladesh Open University

This book has been published after being refereed for the students of
School of Business, Bangladesh Open University



MBA 2306

BUSINESS MATHEMATICS

Published by: Publication, Printing and Distribution Department, Bangladesh Open University, Gazipur - 1705. © Bangladesh Open University. **Date of Publication:** July, 2008. **Computer Compose & Desk-Top Processing:** Mohammad Wahiduzzaman Howlader, **Cover Graphics:** Abdul Malek, **Cover Design:** Monirul Islam, **Printed by:**

All rights reserved by the School of Business, Bangladesh Open University. No part of this book can be reproduced in any form without proper permission from the publisher.

PREFACE

This text book titled *Business Mathematics* is designed and developed for the MBA students of Bangladesh Open University. It is written in modular form and is the first of its kind on Business Mathematics in Bangladesh. The lessons have been so designed that learners find them easy to understand.

The book has twelve units comprising 44 lessons. We do not claim it to be an original contribution. Rather it should be regarded as a textbook of ideas from various renowned writers in Business Mathematics. We have also quoted from different textbooks on Mathematics usually followed by post-graduate students in our universities. Our endeavour has been to present the lessons in a very lucid manner so that they can be understood and assimilated by an average distance learner of the MBA program within the stipulated period of a semester.

Each unit is almost equivalent to one chapter of a conventional text book and contains two to six lessons. Each of them starts with unit “highlights”. In fact the lessons are like the lecture notes of a classroom teacher, each starts with “lesson objectives” and ends with “review questions”. The review questions include practice problems and multiple choice questions (MCQs). We hope that self learners will not find much difficulty in understanding the lessons by themselves and will need only a little help from the tutor.

We are grateful to the honorable Vice Chancellor of BOU, Professor Dr. M. Farid Ahmed who gave us the opportunity to write the book. We are also grateful to the former Dean, School of Business, BOU Professor Dr. M. Ekramul Hoque who gave us the most needed support and enthusiasm to write this book. S. M. Miraj Ahmmod, Associate Professor, School of Business, BOU has made us indebted by his untiring efforts in editing and style editing each and every lesson diligently and meticulously. Our thanks are also due to Mohammad Wahiduzzaman Howlader, Word Processing Operator of the School of Business, for doing very best to complete the task of desktop processing on time.

We shall feel rewarded for our labor if both general readers and self-learners find this book worthwhile and useful.

Professor Dr. M. A. Taher
Dr. Mohammed Shamim Uddin Khan

CONTENTS

Unit-1:	Theory of Set	1
	Lesson-1: Meaning, Methods and Types of Set	3
	Lesson-2: Venn Diagrams	7
	Lesson-3: Addition, Subtraction and Complement of Sets	12
	Lesson-4: Difference and Product of Sets	17
	Lesson-5: Applications of Set Theory to Solve Business Problems	22
Unit-2:	Logarithm	29
	Lesson-1: Nature and Basic Laws of Logarithm	31
	Lesson-2: Natural Logarithm and Antilogarithm	40
Unit-3:	Mathematics of Finance	47
	Lesson-1: Interest	49
	Lesson-2: Depreciation	57
	Lesson-3: Present Value and Future Value of Money	62
	Lesson-4: Annuity	66
Unit-4:	Permutation and Combination	73
	Lesson-1: Permutation	75
	Lesson-2: Combinations	82
Unit-5:	Equations	89
	Lesson-1: Equation and Identity	91
	Lesson-2: Inequality	96
	Lesson-3: Degree of an Equation	100
	Lesson-4: Graphical Equation	105
	Lesson-5: Quadratic Equation	109
	Lesson-6: Application of Equation in Business Problems	116
Unit-6:	Coordinate Geometry and the Straight Line	121
	Lesson-1: Coordinate Geometry	123
	Lesson-2: The Straight Line	130
	Lesson-3: General Form of the Equation of a Straight Line	135
Unit-7:	Functions, Limit and Continuity of a Function	141
	Lesson-1: Functions	143
	Lesson-2: Limit	150
	Lesson-3: Continuity	157
Unit-8:	Differentiation and its Uses in Business Problems	163
	Lesson-1: Differentiation	165
	Lesson-2: Differentiation of Multivariate Functions	175

Lesson-3: Optimization with Lagrangian Multipliers and Cobb-Douglas Production Functions	183
Lesson-4: Business Applications of Differentiation	190
Unit-9: Maxima and Minima	199
Lesson-1: Optimization of Single Variable Function	201
Lesson-2: Optimization of Multivariate Functions	213
Lesson-3: Constrained Optimization with Lagrangian Multipliers	220
Unit-10: Integral Calculus	227
Lesson-1: Indefinite Integral	229
Lesson-2: Methods of Integration	234
Lesson-3: Definite Integral	241
Lesson-4: Applications of Integration in Business	248
Unit-11: Matrix Algebra	255
Lesson-1: Matrix: An Introduction	257
Lesson-2: Matrix Operations	262
Lesson-3: Determinant	269
Lesson-4: Matrix Inversion	278
Lesson-5: Application of Matrices in Business	284
Unit-12: Applications to Economics and Business	291
Lesson-1: Uses of Different Functions in Business and Economics	293
Lesson-2: Elasticity	303
Lesson-3: Consumers' Surplus and Producers' Surplus	308