

A Refresher Course in Mathematics

Frank Werner

*Faculty of Mathematics
Otto-von-Guericke-University Magdeburg
Germany*

Table of Contents

1 Some Mathematical Foundations

1.1 Sets

1.2 Sum and Product Notation

1.3 Proof by Induction

2 Real Numbers and Arithmetic Operations

2.1 Real Numbers

2.2 Basic Arithmetic Rules and the Absolute Value

2.3 Calculations with Fractions

2.4 Calculations with Powers and Roots

2.5 Calculations with Logarithms

3 Equations

3.1 Linear Equations

3.2 Quadratic Equations

3.3 Root Equations

3.4 Logarithmic and Exponential Equations

3.5 Proportions

3.6 Approximate Solution of Equations

4 Inequalities

4.1 Basic Rules

4.2 Linear Inequalities

4.3 Inequalities with Absolute Values

4.4 Quadratic Inequalities

4.5 Further Inequalities

5 Trigonometry and Goniometric Equations

5.1 Trigonometry

5.2 Goniometric Equations

6 Analytic Geometry in the Plane

6.1 Lines

6.2 Curves of Second Order

6.2.1 Circles

6.2.2 Ellipses

6.2.3 Parabolas

6.2.4 Hyperbolas

7 Sequences and Partial Sums

7.1 Basic Notions

7.2 Arithmetic Sequences

7.3 Geometric Sequences

7.4 Properties of Sequences

7.5 Limit of a Sequence

7.6 Partial Sums

8 Functions

8.1 Basic Notions and Properties

8.2 Linear Functions

8.3 Quadratic Functions

8.4 Polynomials

8.5 Rational Functions

8.6 Power and Root Functions

8.7 Exponential and Logarithmic Functions

8.8 Trigonometric Functions

8.9 Composite and Inverse Functions

9 Differentiation

9.1 Limit and Continuity of a Function

9.2 The Derivative of a Function

9.3 Elementary Rules

9.4 The Differential

9.5 Graphing Functions

9.5.1 Monotonicity

9.5.2 Extreme Points

9.5.3 Convexity and Concavity

9.5.4 Limits and Asymptotic Behavior

9.6 Extreme Points under Constraints

9.7 Zero Determination by Newton's Method

10 Integration

10.1 Indefinite Integrals

10.2 Basic Integrals

10.3 Integration Methods

10.3.1 Integration by Substitution

10.3.2 Integration by Parts

10.4 The Definite Integral

10.5 Approximation of Definite Integrals

11 Vectors

11.1 Definition and Representation of Vectors

11.2 Operations with Vectors

12 Combinatorics, Probability Theory and Statistics

12.1 Combinatorics

12.2 Events

12.3 Relative Frequencies and Probabilities

12.4 Basic Probability Theorems

12.5 Conditional Properties and Independence of Events

12.6 Total Probability and Bayes' Theorem

12.7 Random Variables and Specific Distributions

12.7.1 Random Variables and Probability Distributions

12.7.2 Expected Value and Variance

12.7.3 Binomial Distribution

12.7.4 Normal Distribution

12.8 Statistical Tests

List of Notations

List of Figures

Index

References:

1. Werner, F.; Sotskov, Y.: Mathematics of Economics and Business, Routledge, Abingdon (UK), New York (USA), 2006.