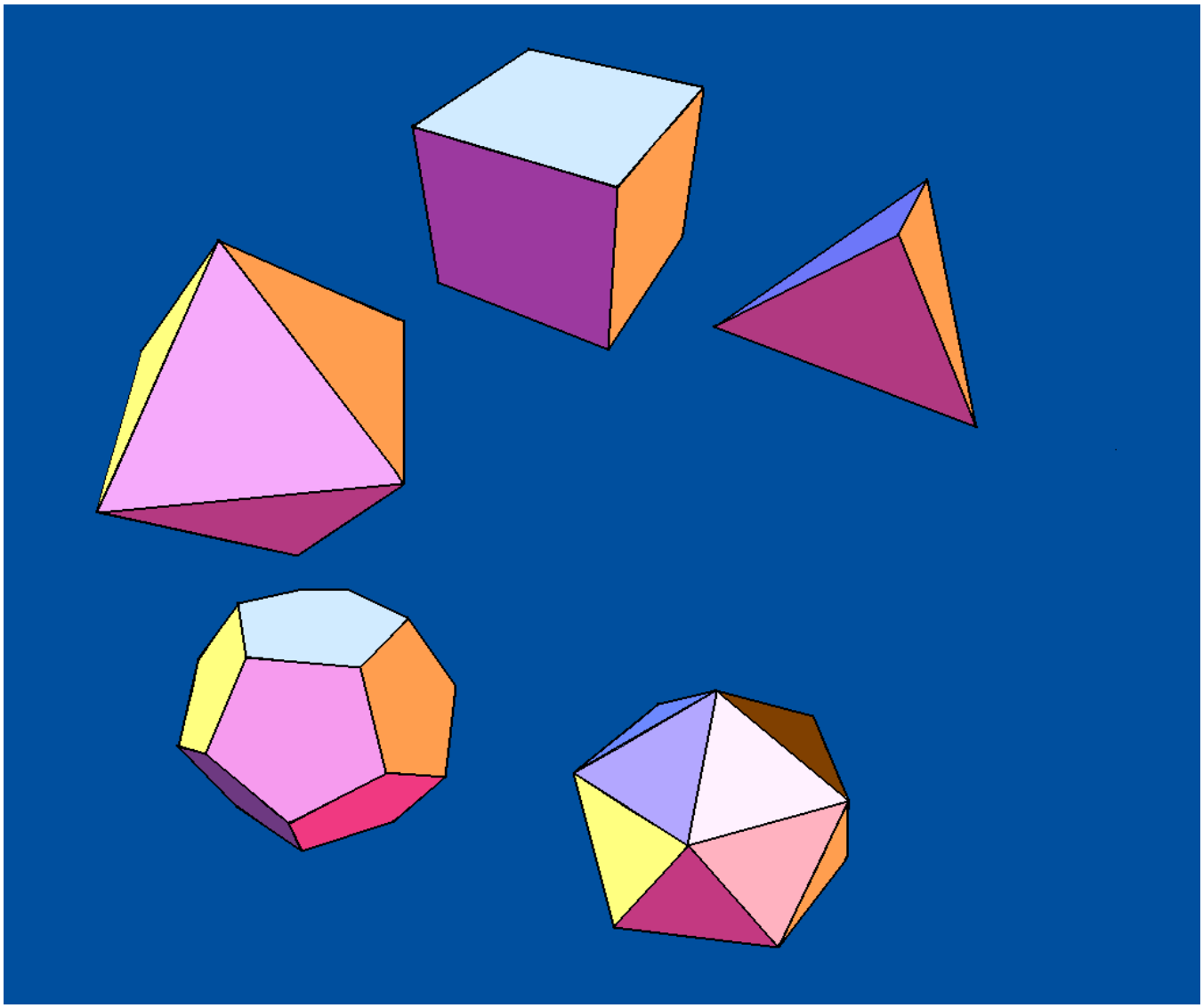
Introduction to Calculus

Volume I

by J.H. Heinbockel



The regular solids or regular polyhedra are solid geometric figures with the same identical regular polygon on each face. There are only five regular solids discovered by the ancient Greek mathematicians. These five solids are the following.

the tetrahedron (4 faces)

the cube or hexadron (6 faces)

the octahedron (8 faces)

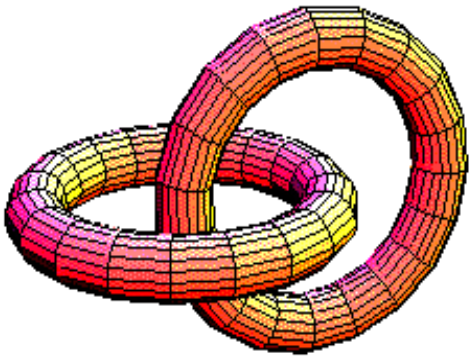
the dodecahedron (12 faces)

the icosahedron (20 faces)

Each figure follows the Euler formula

$$\text{Number of faces} + \text{Number of vertices} = \text{Number of edges} + 2$$

$$F + V = E + 2$$



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This Introduction to Calculus is intended to be a free ebook where portions of the text can be printed out. Commercial sale of this book or any part of it is strictly forbidden.

Preface

This is the first volume of an introductory calculus presentation intended for future scientists and engineers. Volume I contains five chapters emphasizing fundamental concepts from calculus and analytic geometry and the application of these concepts to selected areas of science and engineering. Chapter one is a review of fundamental background material needed for the development of differential and integral calculus together with an introduction to limits. Chapter two introduces the differential calculus and develops differentiation formulas and rules for finding the derivatives associated with a variety of basic functions. Chapter three introduces the integral calculus and develops indefinite and definite integrals. Rules for integration and the construction of integral tables are developed throughout the chapter. Chapter four is an investigation of sequences and numerical sums and how these quantities are related to the functions, derivatives and integrals of the previous chapters. Chapter five investigates many selected applications of the differential and integral calculus. The selected applications come mainly from the areas of economics, physics, biology, chemistry and engineering.

The main purpose of these two volumes is to (i) Provide an introduction to calculus in its many forms (ii) Give some presentations to illustrate how powerful calculus is as a mathematical tool for solving a variety of scientific problems, (iii) Present numerous examples to show how calculus can be extended to other mathematical areas, (iv) Provide material detailed enough so that two volumes of basic material can be used as reference books, (v) Introduce concepts from a variety of application areas, such as biology, chemistry, economics, physics and engineering, to demonstrate applications of calculus (vi) Emphasize that definitions are extremely important in the study of any mathematical subject (vii) Introduce proofs of important results as an aid to the development of analytical and critical reasoning skills (viii) Introduce mathematical terminology and symbols which can be used to help model physical systems and (ix) Illustrate multiple approaches to various calculus subjects.

If the main thrust of an introductory calculus course is the application of calculus to solve problems, then a student must quickly get to a point where he or she understands enough fundamentals so that calculus can be used as a tool for solving the problems of interest. If on the other hand a deeper understanding of calculus is required in order to develop the basics for more advanced mathematical