

Contents

| | |
|--|----|
| Preface | 5 |
| 1 Introduction | 7 |
| 1.1 What is Space? | 7 |
| 1.2 Notes on Dimension | 10 |
| 1.3 Notes on Geometry | 12 |
| 1.4 Coordinate Systems | 13 |
| 1.5 Parallel Projection | 16 |
| 1.6 On Solids | 21 |
| 1.7 Answers and Hints | 22 |
| 2 Vectors | 30 |
| 2.1 What are Vectors? | 30 |
| 2.2 Adding Vectors | 34 |
| 2.3 Multiplication of a Vector by a Scalar | 37 |
| 2.4 Scalar Product and the Angle Between Two Vectors | 41 |
| 2.5 Vector Product | 47 |
| 2.6 Mixed Product | 52 |
| 2.7 Answers and Hints to Exercises | 54 |
| 3 Basic Objects in Space | 61 |
| 3.1 Points | 61 |
| 3.2 Lines | 61 |
| 3.3 Parametric Equations of Planes | 63 |
| 3.4 Cartesian Equations of Planes | 66 |

| | | |
|----------|--|------------|
| 3.5 | More About Equations | 69 |
| 3.6 | Answers and Hints to Exercises | 70 |
| 4 | Relations Among Basic Objects | 74 |
| 4.1 | Points | 74 |
| 4.2 | Points and Lines and an Important Note on Distance | 74 |
| 4.3 | Points and Planes | 79 |
| 4.4 | Lines | 85 |
| 4.5 | Lines and Planes | 97 |
| 4.6 | Planes | 106 |
| 4.7 | Answers and Hints to Exercises | 114 |
| 5 | Solids | 120 |
| 5.1 | Sections of Solids | 120 |
| 5.2 | Penetrations of Solids | 127 |
| 5.3 | Polyhedra | 131 |
| 5.4 | Platonic solids | 133 |
| 5.5 | Answers and Hints to Exercises | 137 |
| 6 | Volume and Surface | 143 |
| 6.1 | What is Volume and Surface? | 143 |
| 6.2 | Volume and Surface of Basic Solids | 145 |
| 6.3 | The Cavalieri Principle and its Application | 147 |
| 6.4 | Motivation for Integration | 149 |
| 6.5 | Volume by Means of Integration | 157 |
| 6.6 | Surface by Means of Integration | 162 |
| 6.7 | Answers and Hints to Exercises | 167 |